

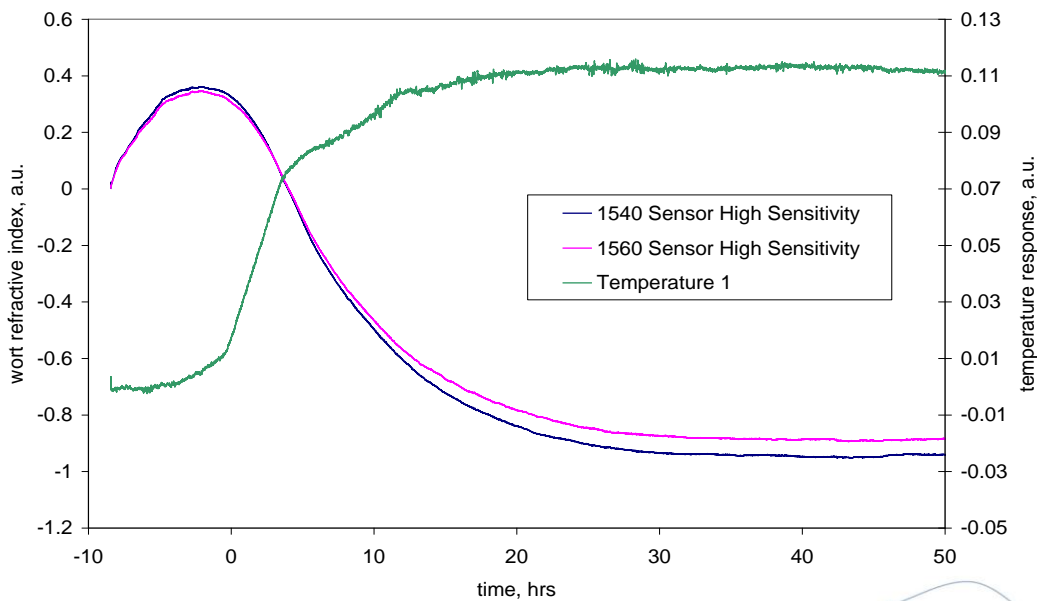


Fermentation – Alcoholic beverage production

Alcoholic (beer and whisky) production is a process that blends modern commercial quality requirements with traditional world wide production methods. Based on a seasonally variable crop – maintaining quality is both difficult and critical.

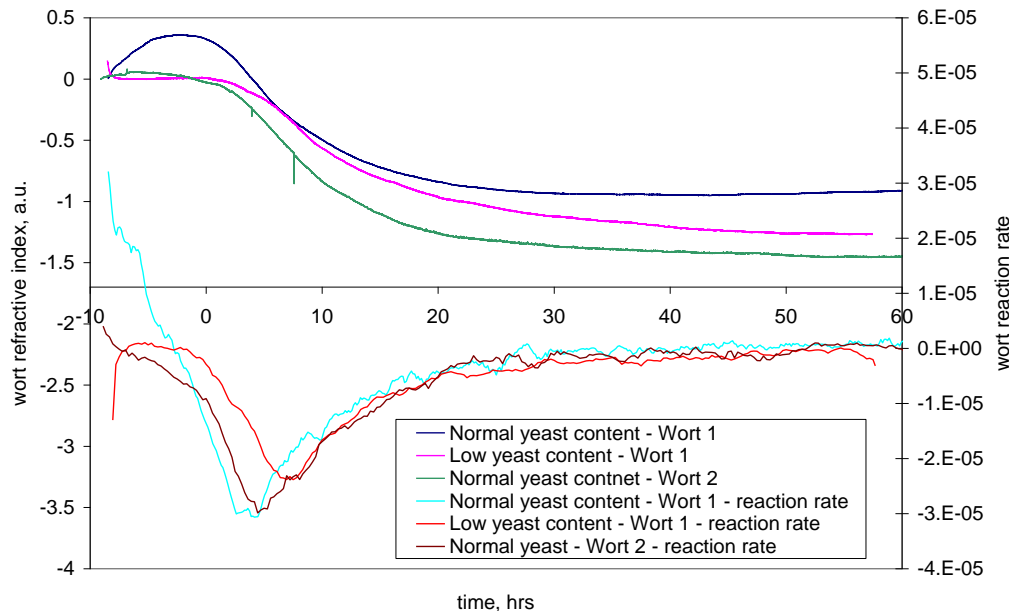
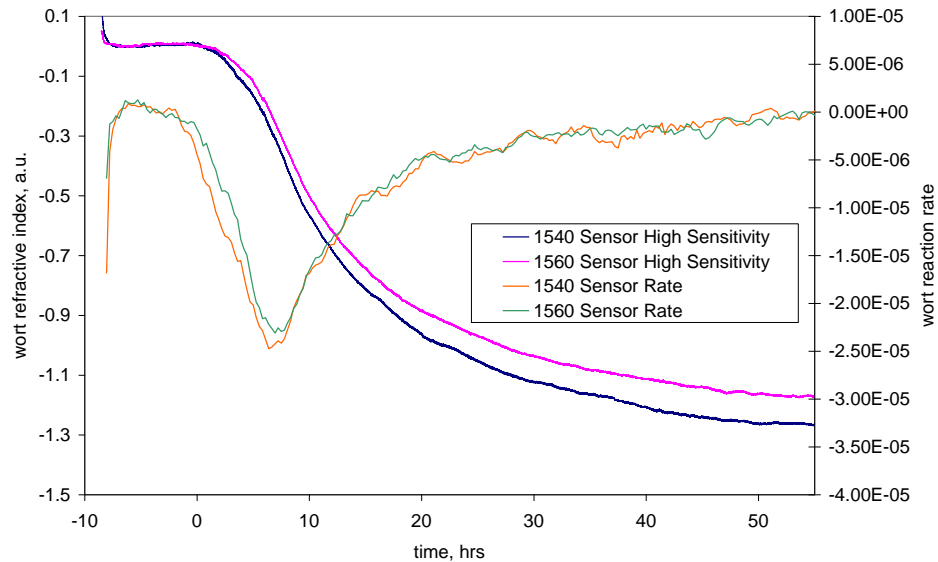
Alcoholic beverage production including beer, wine and spirits all start with a fermentation process. The first stage of the process involves the production of the source liquid for the fermentation process – in the case of beers and whisky this material known as wort. Wort is produced from the mashed up barley and other adjunct grain types (depending on desired output) producing a starting material rich in sugars and enzymes (the process for sugar production in the wort). This process results in a complex feed stock – often containing variable levels of sugars, components grains and particulate matter that will change how the fermentation progresses. Monitoring the rate of fermentation allows understanding and potentially control of the brewing process. The SpectroSens system monitoring the temperature and refractive index of the wort offers an ideal measurement method to allow understanding of this varied production process.

Stratophase have performed initial trials in external laboratories aimed at understanding the benefits of real-time monitoring of the fermentation process in this process. Trials have focused on 10L (right) 'sample' fermentations with a sample reaction trace for a fermentation run is shown below showing the overall refractive index of the liquid (using two wavelengths) and the temperature.





The SpectroSens system clearly provides an over view of the fermentation process – both the overall refractive index and the temperature profile – resulting in the identification of various process stages. The high sampling rate of the SpectroSens allows for additional kinematic data to be captured with the profile – enabling key points within the fermentation process to be easily identified. This is characterised by the *wort reaction rate*, which is the rate of change of wort content with time allowing easy identification of the ‘point of maximum’ fermentation or maximum reaction rate. The overall refractive index profile and reaction rate is shown in the example right – this reaction was initiated with lower levels of yeast than the previous fermentation.



Initial studies investigated the comparison of differing fermentation chemistries, and attempting to identify differences in the fermentation reactions through monitoring the process rather than measurement of the end product. Three combinations were monitored, 1) typical yeast and a simple wort mixture, 2) low levels of yeast with the same wort and 3) typical yeast concentration with a more complex wort source containing high levels of grain particles in the mixture. The results show left, showing both the overall RI response (top traces) and the reaction rate (bottom traces) clearly show that both distinct traces for the different reaction types can be obtained and key process points can be identified.